MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

ECE 2066 – OPERATING SYSTEMS

(ME, CE)

12 OCT 2016
2:30 P.M- 4:30 P.M.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 8 pages with 4 Questions only.
2. Attempt **ALL FOUR** questions in this paper. All questions carry equal marks and the distribution of marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

Question 1

(a) Give an example each for the following classes of operating system:
- Mobile operating system
- Desktop operating system
- Server operating system

[3 marks]

(b) State and discuss FOUR (4) common services provided by an operating system.

[8 marks]

(c) With the help of suitable examples, differentiate the following three terms:
- Program
- Process
- Thread

[6 marks]

(d) Operating systems use various control structures for managing processes and resources.

(i) Discuss the functions for each of the following control structures.

- Memory tables
- I/O tables
- File tables
- Process tables

[4 marks]

(ii) With the help of suitable diagram, show the information maintains by the process control structures.

[4 marks]

Continued...

Question 2

(a) Explain the following terms in the context of concurrency:

- Critical section
- Mutual exclusion
- Deadlock
- Starvation
- Atomic operation

[10 marks]

(b) Consider the C program shown in Figure Q2. Answer the following questions:

(i) How many threads exist in the program? Discuss your answer.

[2 marks]

(ii) Identify the critical section of the program. Discuss your answer.

[2 marks]

(iii) What is the value of variable `count` at the end of the program? Discuss your answer.

[3 marks]

(iv) Discuss the technique used in achieving mutual exclusion in the program.

[5 marks]

(v) Suppose that the technique discussed in (iv) is removed from the program. What will the value of variable `count` be at the end of the program? Discuss your answer.

[3 marks]

Continued...

```
#include <pthread.h>
#include <semaphore.h>
#include <stdio.h>
#include <stdlib.h>

#define NITER 10000
int count = 0;
sem_t *semaphore;

void *ThreadAdd(void * a) {
    int i, tmp;
    for(i = 0; i < NITER; i++) {
        sem_wait(semaphore);
        tmp = count;
        tmp = tmp+1;
        count = tmp;
        sem_post(semaphore);
    }
    return NULL;
}

int main(int argc, char * argv[]) {
    pthread_t tid1, tid2;
    semaphore = sem_open("/tmp/sem", O_CREAT, 0644, 1);

    if(pthread_create(&tid1, NULL, ThreadAdd, NULL)) {
       printf("\n ERROR creating thread 1");
       exit(1);
    }

    if(pthread_create(&tid2, NULL, ThreadAdd, NULL)) {
      printf("\n ERROR creating thread 2");
      exit(1);
    }

    if(pthread_join(tid1, NULL))     {
      printf("\n ERROR joining thread");
      exit(1);
    }

    if(pthread_join(tid2, NULL)) {
      printf("\n ERROR joining thread");
      exit(1);
    }

    if (count < 2 * NITER)
        printf("\n BOOM! count is [%d], should be %d\n", count, 2*NITER);
    else
        printf("\n OK! count is [%d]\n", count);

    pthread_exit(NULL);
}
```

Figure Q2

Continued...

Question 3

(a) Figure Q3 shows the current snapshot of main memory of a system.

(i) Describe briefly the working principle of each of the following algorithms:

- First-fit
- Next-fit
- Best-fit

[3 marks]

(ii) Suppose that data blocks of 4M, 2M and 5M are to be placed in the given order. Show the resultant memory structure due to each of the algorithms in (i).

[9 marks]

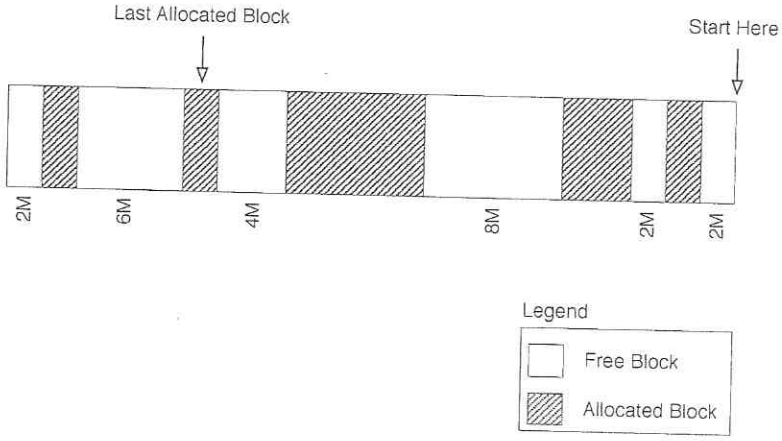

Figure Q3

Continued...

(b) Table Q3 shows the arrival time and burst time for four processes (P1, P2, P3 and P4).

Table Q3

Processes	Arrival Time	Burst Time (ms)
P1	0	3
P2	1	7
P3	2	8
P4	4	5

(i) Describe the operation of each of the following scheduling algorithms. Then apply the algorithms for the processes in Table Q3. Draw out the respective Gantt chart that shows each process's schedule. Show the working steps.

- First-Come, First-Served (FCFS)
- Shortest-Process-Next (SPN)
- Highest-Response-Ratio-Next (HRRN)

[3+3+4 marks]

(ii) Determine and compare the average waiting time performance for the algorithms in (i).

[3 marks]

Continued...

Question 4

(a) Name TWO (2) modern file systems. Then name one operating system that supports the file systems, respectively.

[4 marks]

(b) Figure Q4 shows a snapshot of disk blocks allocation on a file system. Suppose that the file system adopted 16kB block size. With the help of suitable diagrams, explain how a file of 100kB may be stored on the system using each of the following disk blocks allocation techniques:

- Contiguous allocation
- Chained allocation
- Index-node (i-node)

[3+3+3 marks]

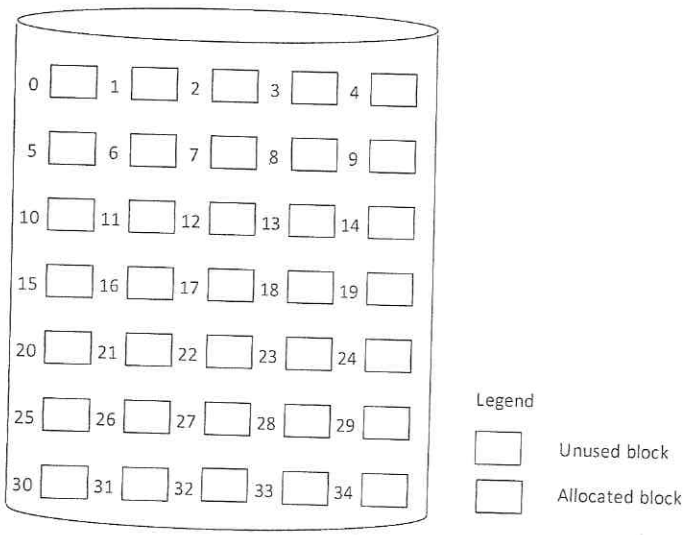

Figure Q4

(c) Caching is a widely used technique in operating system design for performance optimization.

(i) Explain the principle of locality in the context of caching.

[3 marks]

(ii) Discuss briefly the working principle of the Least Frequently Used (LFU) algorithm.

[3 marks]

Continued...

(iii) Consider a cache size of 3. Apply the LFU algorithm to the following input string:

7 0 1 2 0 3 0 4 2 3 0 3 2 1 2.

Show each step of your working.

[4 marks]

(iv) Discuss one disadvantage of LFU algorithm.

[2 marks]

End of Paper